9/20/2017

List of Items to Discuss with the State of Utah, PacifiCorp and AECOM Regarding the Draft "Photochemical Modeling Protocol to Assess Visibility Impacts for PacifiCorp Power Plants located in Utah" (September 2017)

Conference call on 9/20/17

The comments/questions below are listed in the order of where they apply in the protocol. However, the key questions/comments that EPA would like to discuss are highlighted in yellow. Please note that this is only our initial review and that we would only reach a final conclusion regarding the adequacy of the modeling when we act on a corresponding SIP submittal through notice and comment rulemaking.

1. Section 2.1.1, Typical Year (2011) Modeling Scenario.

   EPA question: We understand that the modeling will use temporal profiles for the EGUs in question that are from a more recent period than from 2001-2003. Can you identify the years to be used, and the reasoning behind choosing those years?

   AECOM response: We updated the protocol with temporal profiles that reflect the average of 2001-2012 in order to capture a realistic profile that minimizes the day to day fluctuations.

2. Section 2.1.3, USEPA FIP (2025) Modeling Scenario.

   EPA Comment. This section states that the annual NO_x emissions for the four BART units are calculated from the SCR-based emission limit of 0.07 lb/MMBtu. However, the emission limit is based on a 30-day rolling average, while it is the predicted actual annual emission rate that is needed to calculate annual NOx emissions. The actual annual emission rate will be lower than the 30-day emission limit because of the longer averaging period, and because the emission limit requires some margin for compliance. Therefore, we recommended that PacifiCorp use the predicted annual average emission rate of 0.05 lb/MMBtu for the purpose of calculating the 2025 NOx emissions for the BART units under the FIP scenario. This would be consistent with how EPA calculated annual SCR-based NOx emissions for the purpose of assessing cost effectiveness in our FIP.

   AECOM response: AECOM used the annual average emission rate that corresponds to 0.05 lb/MMBtu. The value of 0.07 lb/MMBtu was a typo and the protocol has been updated with the correct text.

3. Sections 2.13 and 2.1.4, Control Scenario Modeling (Tables 2-4 and 2-5).

   EPA comment: The tables show much lower SO_2 emissions for the units at Hunter and Hunter in the BART alternative scenario than the FIP scenario. Consistent with how UDAQ performed CALPUFF modeling for the BART alternative, the SO_2 emissions for all Hunter and Huntington units should be the same between the FIP and BART

alternative scenarios. Only the SO_2 emissions for the Carbon Power Plant should vary between the two control scenarios.

AECOM response: SO2 emissions at Hunter and Huntington will be same in the FIP and BART Alternative. Carbon will be shut down in the BART Alternative.

4. Section 2.2.1.1, Horizontal Modeling Domain.

   EPA comment: The 4-km domain is based on a 300-km radius that relates to the distance to which CALPUFF is considered reliable, and so is not necessarily applicable to a photochemical grid modeling exercise. In addition, recirculation may occur at the edges of the current 4-km domain where certain Class I areas are located. Accordingly, we recommend that the 4-km domain be extended, particularly to the east, north, and south.

   AECOM response: The 4-km domain proposed for this study has been extended by 9 cells (36 km) on each direction: east, north and south relative to the one presented in the first protocol draft. We believe the original domain proposed was large enough to minimize recirculation issues because it extended over mountain ranges; however the additional grid cells should ensure any recirculation is minimized even further. The nine Class I areas selected were part of the analysis that was the focus of the modeling performed in support of the Utah regional haze FIP; however the new computational domain includes six additional Class I areas that were not part of the CALPUFF analysis but have now been indicated in Figure 4-1and will be included in the visibility analysis.

5. Section 3.2, WRF Model. "The WRF model output will be processed as needed with the WRFCAMx processor to generate the 36-km, 12-km, and 4-km meteorological inputs for all the CAMx modeling simulations in this study." (pdf page 24)

   EPA question: The processed WRF outputs are available from the IWDW. Will the IWDW files be processed to window down from the IWDW 4-km domain?

   AECOM response: We will rely on a final 4-km domain to perform the simulations detailed in the protocol. Our intent is to use as much of the WAQS 4-km meteorology without modification to avoid introducing differences relative to the original modeling platform. However, as we develop the required inputs it might be necessary to rerun the WRFCAMx processor using IWDW's 4km WRF modeling outputs. We have requested to the IWDW the corresponding processing software and scripts to ensure the CAMx ready meteorology is consistent with the WAQS.

6. Section 3.2.1, Meteorological Inputs to Emissions and Air Quality Models. Page 24-25: "Since the WAQS performed CAMx simulations for the 36-km Continental U.S. (CONUS),12-km western U.S. (WESTUS) domain and 4-km domain covering the states of Colorado, Wyoming, and Utah and neighboring areas, it is expected that the study proposed here will not require processing of the WRF meteorology with WRFCAMX and

MCIP for those domains. However, both programs might have to be used to process the WRF meteorology for the 4-km domain described in Chapter 2. This will be assessed once the WAQS data has been provided." (pdf pages 24-25)

EPA comment: MCIP is a preprocessor for CMAQ so it should not be needed for this application.

AECOM response: We agree with EPA that MCIP will not be needed for any processing and therefore the protocol has been updated to remove any references to MCIP.

7. Section, 3.3.1 SMOKE Processing. "As stated in Chapter 2.0, the typical year emission inventories for all domains will be directly taken from the WAQS, which was processed using the SMOKE model. Since the 4-km domain proposed in this study is a subdomain of the original 4-km WAQS, AECOM will extract the final emissions from the 4-km WAQS domain. AECOM will re-process the WAQS emissions combined with the modified PacifiCorp power plant emissions through SMOKE in a manner consistent with the WAQS." (pdf page 26)

   EPA comment: Please review how point sources were treated in the WAQS CAMx modeling. It should be possible to modify the WAQS point source files to replace the original emissions for these EGU with the 2000-2003 average data, and use the other WAQS emissions files without reprocessing.

   AECOM response: CAMx reads a single point source file for each day that integrates the information not only from EGUs but any other sectors or sources. The statement in section 3.3.1 of the protocol indicates that the modified point sources (those related to PacifiCorp EGUs only) will ultimately be merged or integrated with the rest of the point sources using SMOKE in a manner that will be consistent with the WAQS to avoid unintended changes to the inventory. We ultimately agree with EPA that point source files provided by WAQS should be modified and replaced only for the targeted PacifiCorp Power plants. The cumulative surface emissions for our proposed modeling domain will be extracted from the larger 4km WAQS domain using a "window" processing program provided by Environ-Ramboll. This should not modify the surface emissions relative to the WAQS.

8. Section, 3.3.1 SMOKE Processing. "In addition to the CAMx-ready input files generated by SMOKE for each hour of each modeled day, a number of QA files will be prepared and used to check for errors in the emissions inputs. Importing the model-ready emissions into the Package for Analysis and Visualization of Environmental data (PAVE) or the NCAR Command Language (NCL) for visualization, and looking at both the spatial and temporal distribution of the emissions, provides insight into the quality and accuracy of the emissions inputs." (pdf page 26)

EPA comment: PAVE will not generate spatial plots for CAMx point source files. Another method is needed to QA these files.

AECOM response: AECOM has obtained software and processing scripts from EPA-OAQPS to post-process CAMx point source files, in which CAMx-ready binary files can be converted to CMAQ-like netcdf files. The netcdf files can be displayed using either PAVE or NCL for visualization. Additionally, the post-processing software can generate hourly/daily/yearly total point source emissions in ascii file format for additional QA.

9. Section 3.4.1, Initial and Boundary Concentration Data.

   EPA recommendation: IC files for the 4-km domain should be available from the IWDW/WAQS study.

   AECOM response: AECOM will rely on a stand-alone approach in which visibility estimates will be derived from the modeling output of the proposed 4km domain. This requires that the IC and BC be extracted from existing three-dimensional modeling output from the coarser 12km WAQS results. IWDW has provided AECOM the three-dimensional concentration data for this purpose.

10. Section 3.6.2, Air Quality Model Performance. "CAMx showed significant under-prediction in NO3 when comparing ambient monitoring data. It has the worst performance from all the other PM2.5 species." (pdf page 30)

    EPA Question: It is possible that the negative bias for nitrate could be caused by underestimates of ammonia in the 2011 NEI, and this is consistent with findings by Utah DEQ in their PM2.5 SIP modeling in which they increased ammonia emissions in the Cache Valley and Wasatch Front to improve model performance for ammonia and ammonium nitrate. In regard to the significant under-prediction of nitrate, have you considered making adjustments to the ammonia emission inputs in a manner similar to that for the Salt Lake City PM2.5 SIP modeling?

    AECOM response: We have looked and considered this comment carefully; however we think adjustment of ammonia emissions for the present study would not be appropriate because:
    a) UDAQ has indicated the ammonia injection artificially adds ammonia to the current inventory in the context of improvements of performance for the PM2.5 SIP modeling
    b) Diagnosis and improvements of the 2011b modeling platform is beyond the scope of this study
    c) Our approach to estimate visibility impacts using relative response factors (RRF) along with the source apportionment should mitigate the shortcomings of the modeling platform

We have requested more information from UDAQ about their ammonia injection approach which "artificially adds non-inventoried ammonia emissions to the inventoried emissions". We understand this approach was an attempt to improve the model performance for ammonia with available and limited ambient ammonia measurements for 2016 which is a different year than the WAQS modeling platform (2011). UDAQ's approach is in the context of the SIP modeling and is more relevant for the non-attainment counties in northern Utah. Those areas are not the focus of the current project. Notice that that the 2011b MPE document indicates that "the models are not accurately capturing at least one key parameter needed to estimate ambient NH3." UDAQ more specifically points to two reasons on why they use ammonia injection: a) because ammonia deposition velocity rates in the model might be too high and b) the inventory in the regions of interest lack ammonia sources.

The 2011b MPE also indicates that overestimation of the deposition of nitrate could be a source of the negative bias, but a more likely source would be the underestimation of urban NOx emissions in the summer and fall. It is clear that trying to improve the performance of the current modeling platform requires further diagnosis in order to correct these deficiencies, which is beyond the scope of this project. We believe the proposed approach for this study that relies on the use of relative response factors (RRF), as well as looking at the "differences" among scenarios should mitigate some of the modeling platform limitations.

11. Section 3.6.2, Air Quality Model Performance. "Nevertheless, CAMx PM2.5 performance in CO, WY and UT is within the performance goals, indicating the model biases in the three states are representative of the 4-km modeling domain as a whole." (pdf page 30)

    EPA Comment: It is not clear what is meant in the above statement. We recommend revising the text to summarize the findings of the WAQS MPE.

    AECOM response: The statement has been removed and a summary of some of the WAQS MPE findings is provided instead.

12. Section 4.2, Methodology. "To convert model concentrations into visibility conditions and account for quantifiable model bias, the USEPA's Modeled Attainment Test Software (MATS) tool version 2.6.1 (Abt Associates, Inc. 2014) will be used." (pdf page 31)

    EPA Comment: We recommend use of the SMAT computer module instead of MATS. SMAT will be available in the next two weeks, and it has the most recent IMPROVE data and easily allows for sufficient significant digits in the outputs.

AECOM response: AECOM accepts EPA's recommendation to use SMAT-CE for this project with the caveats that the protocol might not reflect the final release version of this software and AECOM assumes that appropriate Quality Assurance of this tool has been performed by the agency. The protocol has been updated accordingly

13. Section 4.2, Methodology. "The visibility improvements from two emissions strategies can be compared using a proposed "better-than-USEPA FIP" assessment that consists of a two pronged test. Under the first prong, visibility must not decline at any Class I area for the PacifiCorp scenario when compared to future baseline visibility conditions (i.e., the Baseline scenario). This prong is satisfied if the difference between the PacifiCorp scenario and the Baseline scenario is negative or zero at each Class I area. Under the second prong, the average visibility over all Class I areas must be better under the PacifiCorp scenario than under the USEPA FIP scenario. For the second prong, the average visibility improvement over all affected Class I areas must be negative or zero. It is acceptable if some Class I areas show greater improvement under the USEPA FIP scenario, as long as the average improvement is larger under the PacifiCorp scenario." (pdf page 33)

    EPA Comment: The text needs to address both the worst and best visibility days.

    AECOM response: The protocol has been revised in this section to explicitly say that the approach will be used for both the 20 percent best and worst days.

14. Section 4.2, Reporting and Analysis.

    EPA Comment: Consistent with the two-prong test at 40 CFR 51.308(e)(3), the model results must be provided for both 20 best and worst days. Currently, this section only mentions the 20 worst days (though the 20 best days are mentioned in earlier sections). Also, include sample table for 20 best days.

    AECOM response: The protocol has been revised to include the analysis and a sample table for the 20 percent best days.